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[54] **MINING MACHINE WITH SPRAY NOZZLES FOR SUPPLY OF DUST SUPPRESSION LIQUID**

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[51] **Int. Cl.** **E21c 35/22**

[58] **Field of Search** 299/81; 175/340, 393; 239/590, 590.3, 600, 596

[56] **References Cited**

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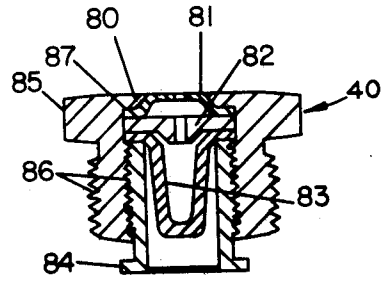
[57] **ABSTRACT**

A rotary cutter head for a mining machine with nozzles mounted thereon for supply of dust suppression fluid to the cutting zone of the cutter head. The nozzles are disposed in front of the cutter bits of the head in the plane of rotation of the bits. Each nozzle comprises a block having a nut-like head portion and a screw thread portion. The block is hollow to accommodate internal nozzle components such as an orifice disk, a core and a strainer. The block also has both external and internal threads. A cap is threaded into the internal threads to hold the internal nozzle components in their relative positions. The external threaded portion is screwed into an appropriate opening in the surface of the cutter head presenting a low profile of less than one quarter inch above the surface of the opening.

4 Claims, 5 Drawing Figures



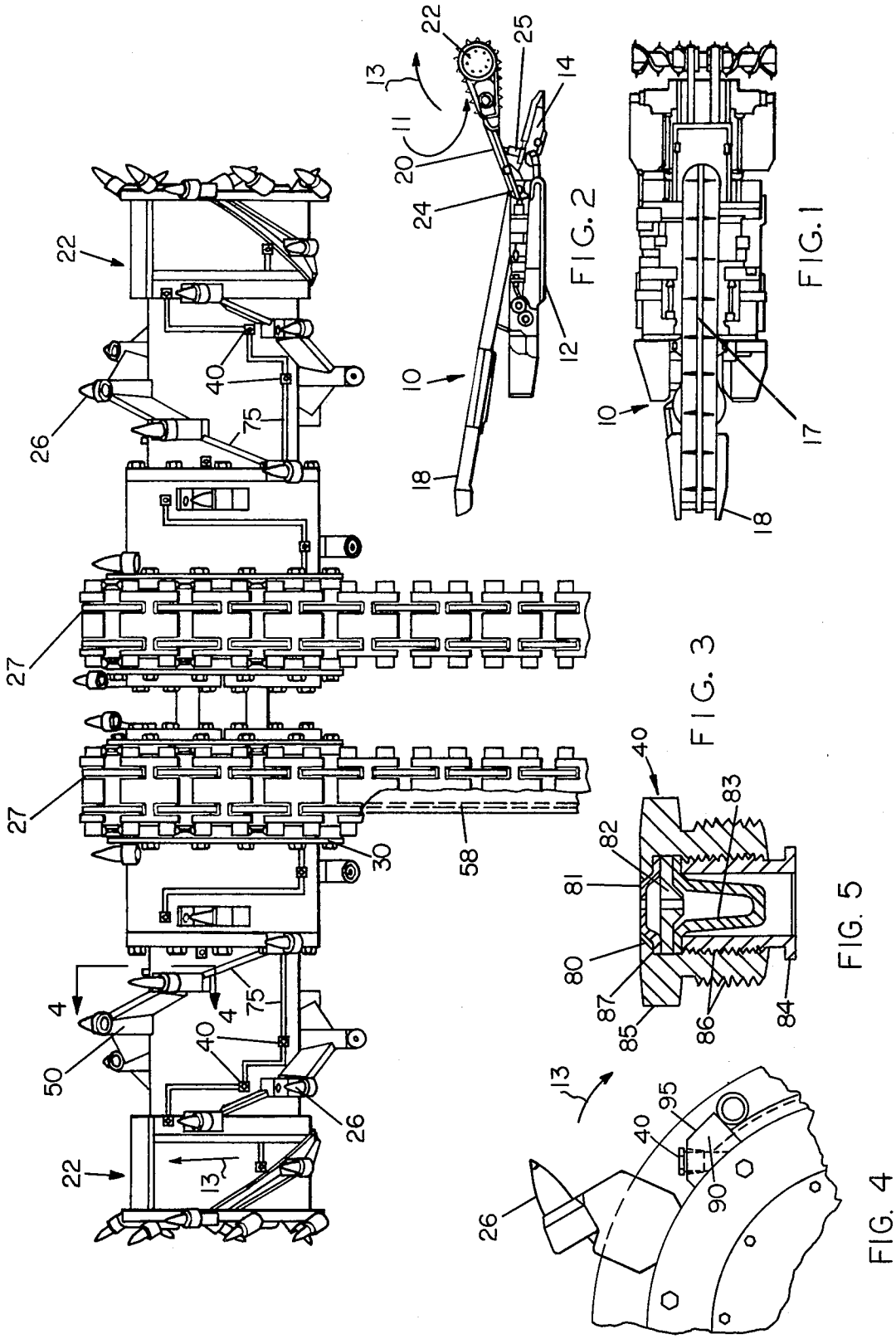


FIG. 1

FIG. 2

FIG. 3

FIG. 5

FIG. 4

MINING MACHINE WITH SPRAY NOZZLES FOR SUPPLY OF DUST SUPPRESSION LIQUID

BACKGROUND OF THE INVENTION

This invention relates generally to continuous mining machines and more specifically to apparatus for suppressing the dust which typically arises during the operation of such mining machines. In particular the invention relates to rotary cutters which are provided with fluid nozzles for supplying dust suppression liquid into the cutting zone.

During the operation of continuous miners large amounts of dust are inherently generated. This dust unless suppressed, collected or removed may present a hazard to the health and safety of the personnel in the mine. Conventionally means such as large vaccuum devices or banks of water spray nozzles mounted behind the rotary cutting heads have been used. However, more recent work has been directed at mounting the spray nozzles on the rotating cutter heads or augers. Such machines are generally called "wetheads" or "wet auger" mining machines. These wet auger machines are effective at dust suppression. The reason is evidently because the water is directed more closely to the cutting zone and suppresses the dust before it becomes airborne. Thus, the water is more efficiently used. However, the success of the wet auger is yet to be proven as far as operating life and maintenance requirements are concerned. One particular difficulty is that the nozzles which are located on the cutting head tend to be plugged by fine materials moving opposite to the waterflow. Also to be most effective the nozzles should be located just forward of the cutter bits in the plane of rotation of the bits. It is critical that the nozzles be protected from being destroyed during the mining operation. At the same time it is essential the nozzles be accessible for replacement with minimal time investment.

SUMMARY OF THE INVENTION

Accordingly it is the object of the present invention to provide an improved nozzle means for use on rotary cutting heads of mining machines.

Another object of the invention is to provide a nozzle for supply of dust suppression liquid which presents a low profile which is easily protected from destruction and less prone to be plugged by fine material.

A further object of the invention is provide a low profile water spray nozzle which is easily mounted on the surface of the cutter head and which is easily replaced and maintained.

The invention accomplishes the above and other objectives by providing a water spray nozzle having a heavy duty body and cap. The nozzle body is a nut-like block that has a hollow interior to accommodate the orifice disc, core and strainer of the nozzle. The body also has an internal screw thread for insertion of the cap which holds the internal pieces of the nozzle together. In addition, the body also has an external screw thread so that it may be screwed into a corresponding opening in the auger surface. This nozzle presents a very low profile extending less than one quarter inch above the mating thread. It may be easily changed with channel locks or socket wrenches. Because of its low profile the nozzle may be positioned directly in front of the bit and aimed slightly in advance of the nearest trailing bit. Also, because of the low profile, the nozzle presents a minimum of interference to the cutting function of the bit. And the nozzle is more easily protected by a small raised portion which preceeds the nozzle in its plane of rotation.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a mining machine incorporating the water spray nozzles of the present invention.

FIG. 2 is a side elevational view of the mining machine illustrated in FIG. 1.

FIG. 3 is an enlarged plan view with part in section of a portion of the mining machine shown in FIG. 1.

FIG. 4 is an enlarged view taken substantially along the line 4—4 in FIG. 3.

FIG. 5 is a cross sectional view of a liquid spray nozzle incorporating the features of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A continuous mining machine **10** incorporating the improved dust suppression system and low profile nozzle of this invention is illustrated in FIGS. 1 and 2 of the drawings. The mining machine is a continuous type in which the mining apparatus **11** is disposed at the forward end of the machine to be advanced into a mine face for cutting and breaking material out of the mine face. The mining machine is supported on endless traction treads **12** which are disposed one on each side of the machine and are suitably driven for propelling the mining machine.

The mining head **11** has a boom **20** that extends forwardly to support the rotary cutting and breaking drum **22** at the front end of the mining machine. The boom extends rearwardly and is supported on a pivot structure **25.** The mining head **11** includes a plurality of spirally arranged cutter bits **26** and cutting chains **27** arranged for cutting and breaking material from the mine face. A plurality of liquid spray nozzles **40** are mounted on the rotating mining head **22.** Where possible the nozzles **40** are mounted in front of a cutter bit **26** and are pointed to spray dust suppression liquid in the plane of rotation of the bit. The forward rotation direction is indicated by the arrow **13.** Each nozzle is mounted in a housing which projects from the mining head **11.**

The mining head **11** is driven by electric motors (not shown) which are on opposite sides of the main frame. The drive from the motors is delivered to a transmission and then to universal shafts (not shown). Each universal shaft is connected to a drive shaft which is rotatably mounted in the drive housing and main support.

The mining head **11** is moved upwardly and downwardly by hydraulic clyinders **25** pivotally attached at the lower ends to clevices on the main frame **10** and at the upper ends to the boom **20.**

A gathering head **14** is at the forward end of the mining machine **10** beneath the mining head **11** and is pivotally supported at the pivot structure **24.** Two gathering arms (not shown) on the gathering head **14** gather the mined materials and sweep the material in toward the center of the gathering head onto an endless chain and flight conveyor **17.**

The endless chain and flight conveyor **17** extends longitudinally through the mining machine **10** from the gathering head **14** to the rear end of a discharge conveyor boom **18** which is pivotally supported on the pivot structure **24.**

Dust suppression liquid for the nozzles is supplied by an auxiliary booster pump through appropriate hosing (not shown) to the miner. The liquid flow is controlled by a shut-off valve (not shown) at the operator's pit. The water then passes through a 50 mesh filter under the conveyor **17** and is divided to supply cooling liquid for both the right and left side motors. Once past the motors, a 50 mesh filter and flow control valve (not shown) is located within each of the housings to provide separate flow control and filtration for each side of the cutting head. From the valves, the water is piped along the side of the housing along a channel **58** to a forward housing extension and support member **30** as shown in FIG. **3.** From this stationary support member, the liquid is supplied through an appropriate rotary seal to the rotating auger head. My co-pending application (26,893) illustrates an effective liquid transfer and sealing device. Once delivered to the rotating cutting head the liquid is conveyed through channels **75** welded to the surface of the auger **22.**

FIGS. **4** and **5** illustrate the details of the structure which conveys the dust suppression lqiuid along the rotating mining head **22** to the liquid spray nozzles **40.** The structure is the same on each side of the mining machine **10** except that the elements are oppositely disposed. Therefore, this description will proceed with respect to the liquid conveying structure and nozzles **40** on one side only of the mining machine **10** with the understanding that the description applies equally to the liquid conveying structure and nozzles on the other side of the mining machine.

FIG. **5** illustrates the details of the low profile nozzle **40.** Each nozzle **40** comprises a body portion **80,** an orifice disc **81,** a core **82,** a slotted strainer **83,** and a cap **84.** The body **80** is a bolt-like device having a hexagonal head **85** and an extended body portion **86** which has both external threads and internal threads. The structure **80** is hollow and adapted to receive a conventional orifice disc **81,** core **82,** and slotted strainer **83** which are retained at their upper surfaces by an annular ridge **87.** The orifice disk, core and slotted strainer are inserted into the body **80** and are held in place along their lower region by the cap **84** which is screwed into the internal threads of the cap. The external threads on the body are screwed into appropriate openings on the auger head **22.** Once assembled and screwed into the auger head **22** the only portion of the nozzle **40** which protrudes into the cutting zone is the narrow hexagonal head **85.** Typically, the height of the head **85** is less than one quarter inch.

The nozzle head **85** although presenting a low profile, is large enough to be grasped by a socket wrench or similar tool so that sufficient torque may be applied for removal of the nozzle **40** while in the harsh environment. It is not necessary to handle or reassemble the internal nozzle components **81, 82, 83,** each time a particular nozzle is replaced. Each nozzle assembly **80** is an individual, self-contained unit that may be replaced by a similar unit. However, the design of the nozzle **40** is flexible in that the internal components **81, 82, 83** may be replaced with other conventional components to adapt the internal nozzle structure to varying liquid or mine conditions.

FIG. **4** illustrates the protective housing **90** into which the low profile nozzles **40** are inserted. The nozzles are preferably aimed in the direction opposite to the rotation of the auger head **22.** Each nozzle housing **90** has a front protruding portion **95** which helps protect the nozzles **40** and cut a path for the nozzle where necessary. The nozzles are preferably located just forward of the cutter bits **26** in the plane of rotation of the bits. In this manner the dust suppression liquid is directed very near the point of the bit and its immediate cutting zone.

The nozzles **40** may be located on the back side of the cutting bit holder **50** and the liquid may be directed therefrom at an angle toward the following auger bit **26.** The position within the bit holder housing **50** offers more room for the nozzle. However, such a large space is not required for the nozzles of the present invention. Therefore, it is preferable that the low profile nozzles **40** be located in the more efficient position in front of the auger bits **26.**

Having thus described the invention those skilled in the art will recognize various uses for and changes in the details and arrangement of parts without departing from the scope of the invention as it is defined in the appended claims. It is, therefore, respectfully requested that the invention be interpreted as broadly as possible according to the provisions of the patent statutes and limited only by the scope of the appended claims.

I claim:

1. In a rotatable mining head for a mining machine including means for supplying dust suppression liquid to the mining zone through nozzles mounted in openings in the surface of the rotatable mining head, wherein the improvement comprises a low profile nozzle structure comprising:

a hollow body externally threaded at one end for insertion into threaded openings in the mining head and having a flat low profile geometrically shaped head at the other end, said geometric head being diametrically larger than the opening in the mining head such that in the installed position it rests tightly against the surface of the mining head forming a low profile projection adapted for engagement by a wrench for quick and easy removal of the nozzle,

said nozzle also having an orifice adjacent to the outermost surface of said geometric head and internal nozzle components for insertion in said hollow body and a removable retaining cap adapted for engagement within the hollow body at the end opposite the orifice and effective to hold the internal components within said nozzle.

2. In a rotatable mining head as recited in claim **1,** the further improvement wherein the removable retaining cap is externally threaded for threaded engagement with internal threads within the end of the hollow body of the nozzle.

3. In a rotatable mining head as recited in claim **1,** the further improvement wherein said orifice is in a removable orifice disc retained by said removable cap against a retaining lip formed in the end of said hollow body.

4. A rotatable mining head as recited in claim **3,** wherein the internal nozzle components include an orifice disc, a core and a strainer.

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